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**Incentive Compatible Globalization  
under Preference Differences**

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# Incentive Compatible Globalization under Preference Differences

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## Abstract

We investigate incentive compatible mechanisms for the optimal level of globalization under preference differences. We find that the incentive compatible globalization is possible iff the nation-wise consumptions as well as the global consumption would be greater than the critical values determined by preferences for globalization.

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## 1. Introduction

Since the 1990s, there have been active discussions on “Globalization”. The academic study on globalization has covered a wide range, including international trade, foreign direct investment, technology, labour, environment, finance and even the economic system.<sup>1</sup>

Most of the studies reveal that the expected benefit from globalization may be large

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<sup>1</sup> See Dunning (1998), Thorbecke and Nissanke (2006), Dreher (2006), Obadan (2006), Dutt and Mukhopadhyay (2005), Ethier (2005), and Ahemid (2006).

in pursuit of market enlargement, competition promotion and effective resource distribution. Nevertheless, in the process where globalization is discussed, not all countries have always been in the same position, because the expected benefit from globalization may vary over countries. In particular, the expected benefit from globalization may be still more different among countries, which are in the different stages of economic development. Therefore, it is very difficult for every country to come into an agreement on globalization.

If globalization is offered with incentive for the country whose economy it imposes a heavy burden on, it may induce her, being negative in it, to take part in it. This paper investigates an incentive mechanism as an international economic system (IES), in which globalization is discussed and operated, under incomplete information on preference differences. In particular, this study considers globalization as a kind of international public goods (IPG).

In this paper, we use indirect utility functions of countries as valuation functions in order to formalize the setup of incentive mechanisms.<sup>2</sup> Based on the mechanism design theory of the Groves mechanisms, we analyze the possibility of incentive mechanisms with monetary transfers in the case of preference differences for globalization. We

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<sup>2</sup> By using expenditure minimization behavior Ihori (1994, 1996) could formalize indirect utility functions as valuation functions.

finally characterize a necessary and sufficient condition for the existence of the optimal mechanism.<sup>3</sup>

## 2. Benefit sharing from Globalization

From a practical point of view, there would be four cases of globalization on the basis of expected benefit from globalization and benefit sharing among countries, as in <Fig 1>.

In the case A of <Fig. 1>, every country may be positive and enthusiastic for globalization. So globalization will be positively discussed, easily agreed, and successfully operated; the expected benefit from globalization is large and fairly shared among countries, which take part in the globalization. In this case, there is no problem in discussing and operating globalization.

In the cases B and D, globalization is not worth to be discussed, because small and even minus benefit from globalization is expected.

In the case C, it generally takes place in the real international economic society, in particular, between the developed and developing country. When the large benefit is expected from globalization, it is desirable that countries take a cooperate action for

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<sup>3</sup> Laffont and Martimort (2005) recently analyze the design of incentive mechanisms for the provision of transnational public goods under asymmetric information among countries.

globalization. Nevertheless, there are some cases where the countries are not willing to cooperate actively, especially in the case where every country participating in negotiation for globalization cannot get the impartial distribution of the potential benefit from globalization. However, even in the case C, if fairness would be improved via a cooperative installation of the optimal mechanism, there will be a meaningful globalization. For this, the incentive mechanism with monetary transfers in the case of preference differences in globalization is about to be considered.

<Fig. 1> Benefit from Globalization and its sharing over countries

		Benefit from Globalization	
		Large	Small/minus
Benefit Sharing	Fair	A	B
	Unfair	C	D

### 3. Basic Model

We assume that  $n$  countries are interested in producing and consuming two goods; an international public good  $G$  and a private good  $c$ .  $G$  consists of each country  $i$ 's

contribution  $g_i$ , which is transformed from the private good  $c_i$ ;  $G = g_1 + g_2 + \dots + g_n$ . By assuming that  $c_i$  is a numeraire, country  $i$ 's budget constraint would be  $c_i + p g_i = Y_i$ , where  $p$  denotes the unit cost for producing  $g_i$ , and  $Y_i$  income, respectively. We restrict our attention to quasi-linear utility functions;  $u^i(c_i, G) = c_i + \theta_i \ln(G)$  for country  $i$ .

We assume that  $p$ 's and  $Y_i$ 's are given fixed and public information, and that  $\theta_i$ 's are private information called types. Let  $\Theta_i = [\underline{\theta}, \bar{\theta}]$  be the common set of types with  $\underline{\theta} > 0$ . Let us decompose the state set  $\Theta = \prod_i \Theta_i$  into  $n$  subsets; for each  $i$ ,  $\Theta_i^* = \{\theta \in \Theta \mid \theta_i = \max_j \theta_j\}$  is the set of the states where country  $i$  has the highest preference parameter.

It is well known that there is a free rider problem in this setup. There is an incentive to understate the importance of the IPG in order to reduce the contribution for the IPG because of externality and asymmetric information. Since each country  $i$  knows her preference parameter  $\theta_i$  and is only aware of the distribution of the other country's preference parameters, one of the important roles of the IES would be how to obtain the true information about  $\theta_i$ 's from the member countries.

In order to implement the first-best allocation, we use the Groves mechanism as the

optimal IES.<sup>4</sup>

Thus, we assume that countries can install the IES of an international agency that collects the reports on types and decides allocations and transfers.

The Pareto allocation is that for each  $i$ ,  $g_i(\theta) = \frac{\theta_i}{p}$  and  $c_i(\theta) = Y_i - \theta_i$ , thus  $G(\theta) = \frac{1}{p} \sum_i \theta_i$ . Let  $A$  be the set of all feasible outcomes with  $(c_1, \dots, c_n, g_1, \dots, g_n) \in A$ .

Then, by using indirect utility functions from the above-mentioned method, we may set up a valuation function  $v_i(\cdot, \theta_i)$  over  $A$  for each type  $\theta_i$ . Specifically, the payoff of country  $i$  with type  $\theta_i$  from the reports  $\hat{\theta}$  is

$$v_i((c(\hat{\theta}), g(\hat{\theta})), \theta_i) = \theta_i \ln\left(\frac{1}{p} \sum_k \hat{\theta}_k\right) + Y_i + \hat{\theta}_i. \quad (1)$$

We can verify that the previously mentioned valuation functions satisfy the convexity condition of Holmström (1979). Thus, by following Makowski and Mezzetti (1994) we can apply the Groves mechanism into our setup.

#### 4. Incentive mechanism design under uncertainty of $\theta_i$

A direct mechanism is denoted by  $(\Theta, \langle s, t \rangle)$ .  $\Theta$  is the message space of the type reports.<sup>5</sup>  $\langle s, t \rangle$  is an outcome function which consists of a decision rule  $s : \Theta \rightarrow A$  and a transfer scheme  $t = (t_1, \dots, t_n)$  with  $t_i : \Theta \rightarrow \mathbb{R}$ . Given  $\langle s, t \rangle$ , country  $i$ 's payoff with type

<sup>4</sup> See Groves and Loeb (1975).

<sup>5</sup> Thus, we use the Revelation Principle developed in Dasgupta, Hammond, and Maskin (1979).

$\theta_i$  from a report  $\hat{\theta}$  is  $v_i(s(\hat{\theta}), \theta_i) + t_i(\hat{\theta})$ . We will use the notation  $\langle s, t \rangle$  for a direct mechanism.

The global gain function from the Pareto allocation is

$$g(\theta) \equiv \sum_i v_i(c(\theta), g(\theta), \theta_i) \equiv \left[ \sum_i \theta_i \ln\left(\frac{1}{p} \sum_k \theta_k\right) + \sum_i Y_i - \sum_i \theta_i \right]. \quad (2)$$

As a direct mechanism is installed and a state is realized, countries face a direct revelation game. A mechanism  $\langle s, t \rangle$  is dominant-strategy incentive compatible if every country has the incentive to report her own type honestly regardless of the others' report schemes at any state, i.e., for all  $i$ , for all  $\theta_{-i}$ , for all  $\theta_i$ , and for all  $\theta'_i$ ,

$$v_i(s(\theta_{-i}, \theta_i), \theta_i) + t_i(\theta_{-i}, \theta_i) \geq v_i(s(\theta_{-i}, \theta'_i), \theta_i) + t_i(\theta_{-i}, \theta'_i). \quad (3)$$

A decision rule  $s$  is outcome-efficient if  $\sum_i v_i(s(\theta), \theta_i) = g(\theta)$  for all  $\theta$ , that is, if it always realizes the global gain. A mechanism  $\langle s, t \rangle$  is a first-best dominant-strategy mechanism if it is outcome-efficient and dominant-strategy incentive compatible.

Since our setup satisfies the convexity condition in Holmström (1979), we can use his result that a mechanism is a first-best dominant-strategy if and only if it is a Groves mechanism. Following Makowski and Mezzetti (1994), we can define the participation charge on country  $i$  at state  $\theta$  as the difference of  $i$ 's payoff from the global gain;  $h_i(\theta) \equiv g(\theta) - v_i(s(\theta), \theta_i) - t_i(\theta)$  for all  $i$  and  $\theta$ . A mechanism  $\langle s, t \rangle$  is a Groves mechanism if it is outcome-efficient and its participation charges on country  $i$  are



independent of  $i$ 's type for each  $i$ . Then, country  $i$ 's payoff from the participation in a Groves mechanism at state  $\theta$  is

$$v_i(s(\theta), \theta_i) + t_i(\theta) = g(\theta) - h_i(\theta_{-i}). \quad (4)$$

Since each country's participation charges are non-distortionary lump-sum in Groves mechanisms, there is no incentive for any country to lie in the direct revelation game. One simple Groves mechanism is a mechanism with zero participation charges;  $h_i(\theta) = 0$  for all  $i$  and for all  $\theta$ . Then each country's payoff would be equal to the global gain  $g(\theta)$  at each  $\theta$ , and by using (8) we know that the zero-charge Groves mechanism incurs a deficit  $g(\theta) - v_i(s(\theta), \theta_i)$  for country  $i$  at state  $\theta$ . The (*ex ante*) expected budget deficit for country  $i$  in the zero-charge Groves mechanism is

$$B_i \equiv E[g(\theta) - v_i(s(\theta), \theta_i)] = E\left[\sum_{j \neq i} \theta_j \ln\left(\frac{1}{p} \sum_k \theta_k\right) + \sum_{j \neq i} (Y_j - \theta_j)\right]. \quad (5)$$

A mechanism  $\langle s, t \rangle$  is *ex post* individual rational (EPIR) if its payoff is not negative for any country at any state.<sup>6</sup>

Since the IES does not observe country  $i$ 's type, the maximal amount that the IES can charge on country  $i$  without violating country  $i$ 's EPIR condition is, by using (8),  $c_i(\theta_{-i}) = \min_{\theta_i} \{g(\theta)\}$  for all  $\theta_{-i}$ . Then, the (*ex ante*) expected lump-sum charge without violating country  $i$ 's EPIR condition is

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<sup>6</sup> We assume that the outside option payoff of any country  $i$  at any state is zero.

$$C_i \equiv E[c_i(\theta_{-i})] = E\left[\sum_j \theta_j \ln\left(\frac{1}{P}(\sum_{j \neq i} \theta_j + \underline{\theta})\right) + \sum_j Y_j - \sum_{j \neq i} \theta_j - \underline{\theta}\right]. \quad (6)$$

(5) and (6) might be interpreted as two edges of a 'benefit-charge' analysis, in that for each country the IES measures the benefit from the zero-charge Groves mechanism and levies the corresponding lump-sum charge for it.

In plain terms, an annoying problem in the Groves mechanism literature is how to fairly divide the expected surplus from the mechanism. We introduce two surplus-division methods; equal division and proportional division. The former is related with *ex ante* budget balancedness (EABB),  $E\left[\sum_i^n t_i(\theta)\right] = 0$ . The latter is related with zero expected net transfer (ZENT),  $E[t_i(\theta)] = 0$  for each  $i$ .

Makowski and Mezzetti (1994) obtain a necessary and sufficient condition for the existence of the efficient dominant-strategy mechanism with EPIR and EABB;  $\sum_i C_i \geq \sum_i B_i$ . Now, we propose a necessary and sufficient condition for the existence of an efficient dominant-strategy mechanism with EPIR and ZENT.

**Proposition:** There exists an IES which is first-best dominant-strategy incentive compatible, ex post individual rational (EPIR), and zero-expected net-transferred (ZENT) iff  $E[c_i(\theta_{-i})] \geq E[g(\theta) - v_i(s(\theta), \theta_i)]$  for all  $i$ .

**Proof:** (If) Define a transfer scheme  $t$  by  $t_i(\theta) = g(\theta) - v_i(s(\theta), \theta_i) - c_i(\theta_{-i}) + K_i$  for all

$i$  and  $\theta$ , where  $K_i = E[c_i(\theta_{-i})] - E[g(\theta) - v_i(s(\theta), \theta_i)] \geq 0$ . Then,  $\langle s, t \rangle$  is a Groves mechanism. It's trivial to check out EPIR and ZENT.

(Only if) By the result of Makowski and Mezzetti (1994), it suffices to show that  $E[t_i(\theta)] = 0$  for all  $i$ . By definition,  $E[t_i(\theta_i)] = 0$  for all  $i$ . Q.E.D.

## 5. Implications

The above conditions in the proposition bring forth the range of the consumption level of non-IPG for the existence of the incentive mechanism in the two-country case; for EABB with (7) and for ZENT with (8), respectively.

$$\bar{c}_1 + \bar{c}_2 \geq N \equiv E\left[\ln\left[\left(\frac{\theta_1 + \theta_2}{(\theta_1 + \underline{\theta})(\theta_2 + \underline{\theta})}\right)^{\theta_1 + \theta_2}\right]\right], \quad (7)$$

$$\bar{c}_i \geq N_i \equiv E\left[\ln\left[\frac{(\theta_1 + \theta_2)^{\theta_j}}{(\theta_j + \underline{\theta})^{\theta_1 + \theta_2}}\right]\right], \text{ where } i, j=1, 2 \text{ and } i \neq j. \quad (8)$$

with  $\bar{c}_i \equiv Y_i - \underline{\theta}$  being the maximum consumption level of non-IPG of country  $i$

<<Fig 1> here>

Not only the global consumption level is important, but also each country's consumption level must be large enough to match the existence of the IES. On the other hand, the critical values representing the range of consumption levels are determined

by the parameters of utility functions. Under preference uncertainty, the absolute level of private consumption is an important criterion for establishing an efficient IES with incentive compatibility and individual rationality.

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<Fig. 1>

